Geophysical Research Abstracts, Vol. 9, 10104, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10104

Status of Two Key Elements of the Forward Model in the Longwave: the Water Vapor Continuum and Carbon Dioxide Spectroscopy

S. Clough

Atmospheric & Environmental Research, Inc., Massachusetts, USA (clough@aer.com / 1-781-761-2299 / 1-781-761-2282)

Remote sensing of the atmosphere is critically dependent on the forward model used in the inversion procedure. Small errors in the forward model are leveraged into significant errors in the retrieved elements of the state vector as a consequence of the poorly posed nature of the problem. The objective in remote sensing is to retrieve consistency within rotational bands; between ro-vibrational bands of the same species; between ro-vibrational bands of different species; and finally between absorption bands used with different measurement techniques., e.g. thermal ir and solar ir. We report here on two significant advances in the forward model for the thermal infrared region. (1) Passive remote sounding in this context requires an accurate knowledge of the temperature field for which carbon dioxide is generally used because its spectroscopy has been extensively studied and its mixing ratio in the atmosphere is presumed know to the required accuracy. By introducing carbon dioxide line coupling (Niro et al., 2005), a new chi factor to account for duration of collision effects, and a new carbon dioxide continuum, a substantial simultaneous reduction of residuals between measurement and model within the ν_2 bands and the ν_3 bands of carbon dioxide has been achieved. This improves the consistency between temperature retrievals from AIRS,TES, GOES and assimilation from the respective instruments. (2) The water vapor continuum plays an important role in the radiative properties of the atmosphere and in the remote sensing of many quantities from surface temperature to upper tropospheric humidity. The CKD continuum (Clough et al., 1989) was developed on the basis of a line shape model with $\sim$3 adjustable parameters and was characterized for both self and foreign broadening by exponentially decaying line wings (a theoretical requirement) and a very strong super-Lorentzian component. As measurements have improved since the

first implementation of the line wing formalism, significant improvements have been made in the measurements and our ability to characterize the atmosphere for validation purposes. As a consequence of the need for increased flexibility in the line shape for the continuum model and our inability to explain the large super Lorentz line shape component, a second continuum component representing a collision induced term has been introduced. This change obviates the need for a super Lorentzian line shape and provides the necessary degrees of freedom to fit the observations. The effect of these changes, implemented in the MT_CKD continuum, are presented.